NATURAL RESOURCE SCARCITY AND ADAPTIVE STATES: THE DESIRE FOR INDIVIDUAL FREEDOM VERSUS THE NEED FOR GOVERNMENTAL CONTROL

BY

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ABSTRACT

This study examines states that have adapted to natural resource scarcity. The author builds a framework for analyzing selected case studies based on the social and economic factors scholars argue are necessary for states to adapt. In the cases studied, governments were the key agents in managing resource scarcity but they did not do it directly through policy or legislative efforts. Governments did, however, have an indirect but vital role in setting the social and economic conditions favorable for adaptation. Working in an environment with favorable conditions, individuals emerged with creative and innovative solutions that solved the state's resource shortages. The final section of the study compares states that have adapted to resource scarcity to a modern state that is not adapting to pressures from its natural resources. The social and economic factors common to adaptive states are absent in the nonadaptive state. The state will likely continue to struggle with the management of its resources until steps are taken to address weaknesses in the underlying social and economic environment.

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Introduction

> *Over the next 20 years and more, certain pressures—population, resource, energy, climate, economic, and environmental—could combine with rapid cultural, social, and technological change to produce new sources of deprivation, rage, and instability. We face now, and will inevitably face in the future, rising powers discontented with the international status quo, possessing new wealth and ambition, and seeking new and more powerful weapons. But, overall, looking ahead, I believe the most persistent and potentially dangerous threats will come less from ambitious states, than failing ones that cannot meet the basic needs—much less the inspirations—of their people.*
>
> *Secretary of Defense, Robert M. Gates*

In 2009, the industrialized countries of the world contributed $121.5 billion in developmental aid to non-industrialized countries.[1] Many of the countries receiving aid were on The Fund for Peace and Foreign Policy's Failed States Index for 2010. In the index's six-year history, the top ten failed states have rotated among just 15 countries.[2] Population growth, pervasive infectious disease, shortages in food, water, and other natural resources are just a few of the challenges these states face. Despite massive amounts of developmental aid and foreign assistance, it seems failure is a recurring condition for some states.

As weak and failing states struggle to meet the basic needs of their people, Secretary Gates and other leaders are concerned that the most persistent and dangerous threats to regional and national security will originate not from countries with growing economic and political influence, but from failing ones. Many of the states on the Fund for Peace Index are failing due to a host of pressures Secretary Gates mentioned in his speech to the US Global Leadership Campaign in

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[1] According to the Organization for Economic Cooperation and Development (2010). Available online at www.oecd.org. (accessed 12 April 2011).

[2] The Fund For Peace, "Failed States Index 2010." http://www.fundforpeace.org (accessed 27 January 2011).

2008.[3] Population growth, environmental change, and resource shortages have put pressures on states throughout history. Some states have managed to adapt while others teeter on the brink of collapse?"

The question posed in this study is "Why do some states adapt to shortages from natural resources while others decline or even collapse? For the purposes of this study, adaptation occurs when states modify their behavior or practices as a result of diminishing natural resources instead of migrating to new environments. Decline or collapse occurs when individuals cease to work cooperatively toward the procurement of basic necessities. Non-adaptive states are characterized by widespread violence and instability, ineffective governance, and chronic resource shortages.

The central argument of this paper is that governments were the key agent in managing natural resource pressures but did not do it directly through policy and/or legislative efforts. Governments did, however, have an indirect and vital role in setting the social and economic conditions that were favorable for adaptation. In the cases examined, when governments allowed citizens to own property, provided both domestic and national security, enforced the rule of law, and invested rents collected from resource extraction into infrastructure that facilitated economy-wide development and diversification, individuals emerged with innovative solutions that solved resource shortages.

Chapter 2 explores the debate surrounding natural resource scarcity and builds a framework for analyzing the selected case studies. The chapter examines the roles of governments and individuals in identifying and responding to scarcity along with the social and economic conditions scholars argue are necessary for societies to adapt to resource shortages.

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[3] Gates, Robert M., Secretary of Defense, Address. US Global Leadership Campaign, Washington DC, 15 July 2008.

Chapter 3 examines the Byzantine Empire during the Early Middle Ages. During these years, the Greco-Romans experienced frequent timber shortages—a critical resource used in nearly every facet of life. The construction of warships and merchant vessels consumed large quantities of timber, without which many of the small city-states around the Mediterranean were vulnerable to food and other resource shortages. The Byzantines conserved timber through innovative shipbuilding methods.

Chapter 4 examines England during the Early Modern Period, as it, too, struggled to secure enough timber to sustain a growing population. The English adapted to timber shortages by substituting coal, an abundant resource, in place of charcoal (charred wood) to smelt metal ores in the production of iron. Many scholars contend this discovery made the Industrial Revolution of the eighteenth and nineteenth centuries possible.

After examining two adaptive societies, Chapter 5 looks at a modern non-adaptive one—the Democratic Republic of the Congo (DRC). In the DRC, rents collected from the extraction of natural resources are not invested in infrastructure or institutions that provide the social and economic conditions favorable for an adaptive society to emerge. With the conditions from the previous case studies largely absent, the Congolese will likely have a difficult time adapting to the resource pressures confronting them. Outside agencies focused only on solving the resource challenges that face the Congo could see their efforts fail unless the right socio-economic conditions are in place so that endogenous solutions to resource challenges emerge.

Chapter 6 concludes with additional analysis and observations on the selected case studies.

Chapter 1

A Framework for Examining Resource Scarcity

There is a tremendous amount of scholarly literature devoted to concerns about our planet's ability to sustain a growing population with its finite supply of natural resources. Experts in the disciplines of the arts and humanities, as well as the social, physical, and biological sciences, provide a multitude of perspectives on these issues. The literature on natural resources can generally be divided into one of three categories with various degrees of overlap. Some literature examines the relationship between natural resources and human conflict,[4] others study the possible effects of environmental change on the stock of natural resources,[5] and a third body of literature explores how natural resources either sustain or limit global economic growth and development.[6] At times, it seems the science of natural resources can get confused with the politics of natural resource management as scholars and policymakers argue about how to respond to natural resource challenges.

Malthusians vs. Optimists

Within these three literary categories, arguments can generally be classified as either *Malthusian* or *Optimistic,* depending on whether the outlook for population growth and natural resource availability is bleak or positive. For this reason, Malthusians are sometimes called

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[4] See for example: Michael T. Klare, *Resource Wars: The New Landscape of Global Conflict,* (New York: Metropolitan Books, 2001). Thomas F. Homer-Dixon, *Environment, Scarcity, and Violence,* (Princeton: Princeton University Press, 1999). Jacqueline Vaughn, *Conflicts over Natural Resources,* (Santa Barbara: ABC-CLIO, 2007).

[5] See for example: Stephen C. Lonergan, *Environmental Change, Adaptation, and Security*, Nato Science Series. Partnership Sub-Series 2, Environmental Security, (Dordrecht; Boston: Kluwer Academic Publishers, 1999).

[6] See for example: Clement A. Tisdell, *Natural Resources, Growth, and Development,* (New York: Praeger, 1990). Harold J. Barnett and Chandler Morse, *Scarcity and Growth,* (Baltimore: Johns Hopkins, 1963).

doomsdayers or alarmists while optimists are called boomsters and cornucopians.

Malthusians get their name from Thomas R. Malthus, a professor of economics and history, who wrote a series of essays in the late eighteenth century entitled, *On the Principle of Population.* For Malthusians, the planet cannot sustain a growing population with its limited supply of resources. Pandemics, famine, riots, war, and irreparable environmental damage are likely unless political institutions take action to prevent these disasters from happening. Optimists, on the other hand, argue the planet has plenty of resources to sustain population growth. They notice how, throughout history, humans have had to contend with resource shortages yet have managed to adapt to these constraints through creativity and innovation. For optimists, political intervention isn't necessary and could even be harmful. It is estimated Mao Zedong's experiment with a centrally planned economy killed over 45 million people and is one example of how government control and overreach can have dire consequences.[7] For optimists, as long as economic markets are fair and open, people will adapt to higher prices by conserving scarce resources, finding substitutes, and adapting new technologies.[8]

In his writings, Malthus argued populations, if left unchecked, increased in a geometrical ratio, while subsistence for man increased in an arithmetical ratio.[9] He theorized what he believed was a scientific fact—nature provided a definite limit to the population of mankind. When populations exceeded the earth's ability to provide subsistence, nature corrected the imbalance through mechanisms he called misery

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[7] Frank Dikotter, *Mao's Great Famine,* (New York: Walker Publishing Company, 2010), 127-144.

[8] Charles Maurice and Charles W. Smithson, *10,000 Years of Economic Crisis: The Doomsday Myth,* (Stanford: Hoover Institution Press, 1984), xii.

[9] T. R. Malthus and Gertrude Himmelfarb, *On Population,* (New York: Modern Library, 1960), 15.

(disease and malnutrition) and vice (the making of war). Malthus did not foresee the incredible advancements in agriculture or the multitude of family planning options we enjoy today. The following passage from his *Essay on the Principle of Population* best illustrates his dismal outlook.

> The power of population is so superior to the power in the earth to produce subsistence for man that premature death must in some shape or other visit the human race. The vices of mankind are active and able ministers of depopulation. They are the precursors in the great army of destruction; and often finish the dreadful work themselves. But should they fail in this war of extermination, sickly seasons, epidemics, pestilence, and plague, advance in terrific array, and sweep off their thousands and ten thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear, and with one mighty blow, levels the population with the food of the world.[10]

In recent times, the warnings of Malthus are reflected in the writings of Dr. Paul R. Ehrlich in *The Population Bomb*, and The Club of Rome's, *The Limits to Growth*. The former argues population growth is a cancer that must be stopped through compulsory population controls if necessary,[11] while the latter takes a systemic approach to the broader problems and connections between population growth, natural resources, food production, and industrial development.

In the 1960s, the Club of Rome was organized to promote a better understanding of the various interdependent economic, political, ecological, and social components that comprise the "global system." Writing in 1972, the Club of Rome predicted, "If the present growth trends in world population, industrialization, pollution, food production, and resource depletion continued unchanged, the limits to growth on this planet will be reached sometime within the next 100 years. The most probable result will be a rather sudden and uncontrolled decline in

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[10] Malthus and Himmelfarb, *On Population*, 51-52.

[11] Paul R. Ehrlich, *The Population Bomb,* (Binghamton: Vail-Ballou Press, 1969), 6.

both population and industrial capacity."[12] In their 30-year update to *Limits to Growth,* published in 2004, the authors reaffirmed their predictions from three decades earlier.[13] Although some consider this view too alarmist, history provides evidence to support many of the Malthusian's concerns.

The spread of infectious diseases among countries and between continents as populations expanded has been recorded throughout history. Examples include the spread of the bubonic plague and cholera throughout Europe in the fourteenth century and the introduction of smallpox and measles to the Americas by Europeans in the fifteenth century.[14] In modern times, HIV/AIDS has infected nearly 65 million people globally while 25 million have died and more than 5 million are newly infected every year.[15]

In "Surviving Famine," Andrew Prentice examined the historical record of famines and uncovered over 2,000 documented cases from ancient Egypt, China, the Roman Empire, India, and Northern Europe.[16] Even today, the Food and Agriculture organization of the United Nations estimates 800 million people are chronically undernourished due to food scarcity.[17]

For a Malthusian, policy recommendations might include social and economic changes similar to those made in *Blueprint for Survival.* In his book, Dr. Ehrlich recommends seven sweeping social and economic changes to conserve natural resources. The following passage is an

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[12] Donella H. Meadows et al., *The Limits to Growth,* (New York: Universe Books, 1972), 23.

[13] Donella Meadows et al., *Limits to Growth: The 30-Year Update,* (White River Junction: Chelsea Green, 2004), xviii.

[14] Emily Shuckburgh, ed., *Survival: Survival of the Human Race,* (Cambridge: Cambridge University Press, 2008), 102-103.

[15] Shuckburgh, *Survival,* 106.

[16] Shuckburgh, *Survival,* 146-151.

[17] Jacques Diouf, "Dimensions of Need: An Atlas of Food and Agriculture." www.fao.org/docrep/U8480E/U8480E00.html (accessed 24 January 2011).

excerpt from *Blueprint for Survival*, and serves to illustrate the scope of some neo-Malthusian policy recommendations.

> 1. A control operation whereby environmental disruption is reduced as much as possible by technical means; 2. A freeze operation in which present trends are halted; 3. Asystemic substitution, by which the most dangerous components of these trends are replaced by technological substitutes whose effect is less deleterious in the short term but over the long term will be increasingly ineffective; 4. Systemic substitution, by which these technological substitutes are replaced by "natural" or self-regulating ones—those which either replicate or employ without undue disturbance [sic] the normal processes of the ecosphere, and are therefore likely to be sustainable over very long periods of time; 5. The invention, promotion, and application of alternative technologies that are energy- and materials-conservative, and which because they are designed for relatively "closed" economic communities are likely to disrupt ecological processes only minimally (for example, intermediate technology); 6. Decentralization of polity and economy at all levels, and the formation of communities small enough to be reasonably self-regulating and self-supporting; and 7. Education for such communities.[18]

Although this plan advocates decentralized political and economic institutions and small communities that are self-regulating and supporting, inherent to this idea—and necessary to implement the strategy—is the need for some degree of centralized planning and control. It is hard to imagine any institution other than government with the authority to direct such broad and comprehensive socio-economic changes. Although *Blueprint for Survival* was written in 1972, The Club of Rome has made Malthusian-like policy recommendations as recently as 2004.

The Club of Rome proposes seven general guidelines for restructuring the global system toward sustainability. The seven recommendations that follow are taken from the *Limits to Growth: The*

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[18] Edward Goldsmith, *Blueprint for Survival,* (Boston: Houghton Mifflin, 1972), 24-25.

30-Year Update. In a similar vein as *Blueprint for Survival*, the social and economic changes needed to transition to sustainability require broad and profound social and economic changes.

1. *Extended planning horizons* are needed to impose long-term costs and benefits of global development on today's markets. They argue the long-term costs of our everyday consumption practices are not reflected in today's prices. Tools and incentives are needed to hold societies responsible for issues that unfold over decades.[19]

2. *Improved signals* are needed to inform governments and populations about the impacts of human activity on the world ecosystem. Information about the environment and social conditions should be monitored and reported just as closely as the economic conditions are reported to government and the public. The environmental and social costs of development needed to be included in economic prices.[20]

3. When environments or societies are stressed, *speedy response times* are needed by having in place the institutional and technical arrangements necessary to act effectively. This requires flexibility and creativity along with the ability to redesign physical and social systems. They advocate for an education in systems thinking to assist societies working through these complex problems.[21]

4. *Conserve nonrenewable resources*. Fossil fuels, minerals, and groundwater resources should be conserved through efficient practices. Minerals and water should be recycled and consumed only as part of a transition to renewable resources.[22]

5. *Prevent the erosion of renewable resources*. Renewable resources (forests, fisheries, arable land) should be harvested at rates

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[19] Meadows, *Limits to Growth: The 30-Year Update*, 259.
[20] Meadows, *Limits to Growth: The 30-Year Update*, 259.
[21] Meadows, *Limits to Growth: The 30-Year Update*, 259.
[22] Meadows, *Limits to Growth: The 30-Year Update*, 260.

that ensure they can regenerate themselves. Laws and economic inducements against their overuse need to be put in place.[23]

6. Pursue *maximum efficiency in the use of all resources*. They argue these are economically favorable and technically possible. Efficiencies across all resources will reduce human impacts on the environment and prevent the possibility of a collapse.[24]

7. Finally, action is needed to *slow and eventually stop the exponential growth of population and physical capital*. According to the authors, this last item is the most essential because there are limits to what the other six items can accomplish. They invite the reader to consider "a larger and more truly satisfying vision of the purpose of human existence than mere physical expansion and accumulation."[25]

The thought of population controls, reduced economic freedom, and sweeping social changes has sounded the alarm bells in other academic corners. An equally vigorous group of scholars, primarily economists, have challenged the Malthusian assessment of population growth and natural resource scarcity and offered an alternative strategy.

Countering the environmental determinism of neo-Malthusians are the optimists. This group generally agrees that in the long term, natural resources do not necessarily impose limits to population growth and economic development. For some, population growth might even hold the answer to natural resource challenges.

Julian Simon, in *The Ultimate Resource*, argues the long-run economic indicators do not support the theory that natural resources poise limits to economic growth. Simon bases his analysis of economic growth on the measurable aspects of scarcity—the costs of natural resources in terms of human labor, and their prices relative to wages and to other goods. For him, all these indicators suggest natural resources

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[23] Meadows, *Limits to Growth: The 30-Year Update*, 260.
[24] Meadows, *Limits to Growth: The 30-Year Update,* 260.
[25] Meadows, *Limits to Growth: The 30-Year Update,* 260.

have become less scarce over the long run.[26] Simon also argues impending resource shortages cause people to search for ways to mitigate the shortages which lead to new resource discoveries. Population growth is viewed as a positive factor because it increases the stock of ideas available to solve the challenges of limited natural resources.

Thomas Homer-Dixon makes a similar argument in his examination of the relationship between populations, the environment, resource scarcity, and violence.[27] In his study, Homer-Dixon argues resource scarcities demand immense amounts of human ingenuity in order to adapt to resource challenges. These pressures require tolerance and cooperation but at times they lead to violence and conflict. Once these conditions set in, an exodus of people trying to flee from violence can leave the state with a decreased supply of ingenuity or what he calls an "ingenuity gap" at a time when states need it the most.[28]

Charles Maurice and Charles Smithson, economists at Texas A&M University, examined resource scarcities that challenged societies over the last 10,000 years and discovered when things became scarce people responded with various forms of innovation. The lesson from their book is if consumers and producers are left to work out agreements in a freely functioning market, resource shortages will always be eliminated.[29]

For Optimists, social and economic systems should provide economic liberty, respect for property, and fair and sensible rules of the

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[26] Julian L. Simon, *The Ultimate Resource,* (Princeton: Princeton University Press, 1981), 3.

[27] See: Homer-Dixon, *Environment, Scarcity, and Violence*, (Princeton: Princeton University Press, 1999).

[28]Homer-Dixon, *Environment, Scarcity, and Violence,* 43-44. The factors affecting a society's stock of ingenuity and how it is distributed within a society is the subject of another book he published in 2000. See: Thomas F. Homer-Dixon, *The Ingenuity Gap*, 1st ed., (New York: Knopf, 2000).

[29] Maurice and Smithson, *10,000 Years of Economic Crisis: The Doomsday Myth*, (Stanford: Hoover Institution Press, 1984), xiii-xiv.

market that are enforced equally for everyone.[30] The proper role of government then becomes to "set market rules that are as impersonal and general as possible, allow individuals to decide for themselves how and what to produce and what to consume in a way that doesn't infringe on the rights of others to do the same, where each pays the full price to others of the costs of one's own activities."[31]

The debate on how to adapt to natural resource shortages could be described as the tension between the desire for a degree of individual social and economic freedom versus the need for some level of government control and regulation. A neo-Malthusian might argue for direct government intervention in the form of regulations aimed at conserving resources through rationing or mandating greater efficiencies in the use of natural resources. Optimists are concerned government intervention through regulations could unintentionally stifle individual initiative, creativity, and innovation. An Optimist recognizes the role of government in responding to resource shortages but advocates a more limited role than neo-Malthusians. For an Optimist, governments can help manage resource shortages by providing social and economic conditions that promote individual freedom. Table 1 summarizes the opposing views of Malthusians and Optimists with respect to natural resources, population growth, and the socio-economic changes needed to address natural resource shortages.

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[30] Julian L. Simon, *The Ultimate Resource 2,* (Princeton: Princeton University Press, 1996), 11.

[31] Simon, *The Ultimate Resource 2,* 584.

Table 1: A Summary of Opposing Views on Resource Scarcity

View	Natural Resources	Population Growth	Notional Social and Economic Policy Recommendations
neo-Malthusian Agency: Government (Control)	Finite Supply	Current population growth is unsustainable Leads to environmental degradation & possible collapse	Compulsory population controls if voluntary measures fail Conservation of resources State control of resources and markets
Optimist Agency: The Individual (Freedom)	In the short term all resources are limited but in the long run they do not limit population or economic growth—humans are "resourceful"	Individuals can and will make appropriate reproductive decisions Population growth increases the stock of knowledge needed to solve natural resource challenges	Private Control of Resources Clearly defined legal rules that are enforced equally Ensure the security and stability of property and possessions

Source: Author's Original Work

A Framework for Examining the Social and Economic Conditions of Adaptive States

Although each view differs on how to respond to resource challenges, they both agree that societies can adapt to resource scarcities if certain social and economic conditions are in place. In order to better understand if adaptive societies share similar social and economic conditions, Table 2 proposes a framework for examining these conditions in each of the selected case studies.

Table 2: A Framework for Analyzing Adaptive States

Agency	Economic Factors	Social Factors
Individual	How free were individuals to pursue their own economic self-interests? -Specialized Trades -Subsistence Agriculture	What role did individuals have in identifying and responding to resource scarcity if any? Level of Stability? -War -Lawlessness Social Mobility?
Government	To what extent were states involved in economic markets? -Centrally planned and controlled or Open and competitive How were revenues from taxes/tariffs/rents/resources invested? -Infrastructure -Defense -Into natural resource based activities or into economy wide development & diversification	What role did government have in identifying and responding to resource scarcity if any? What was the nature of the legal system and the rule of law? -Clearly defined -Equal treatment -Enforcement Did governments provide protection for property? -Military -Police -Fire brigades

Source: Author's Original Work

To see if successful adaptors share similar social and economic factors, two examples are selected from Charles Maurice and Charles Smithson's book, *10,000 Years of Economic Crisis*.[32] In each case study, the state's social and economic histories are examined to determine the validity of neo-Malthusians' and Optimists' explanations concerning the population's adaptability to resource scarcity using the framework in Table 2.

The first case examines the social and economic conditions that existed during the Early Middle Ages as the Greco-Romans adapted to timber shortages around the Mediterranean. The second case examines

[32] Maurice and Smithson, *10,000 Years of Economic Crisis,* 72-100.

the English during the Early Modern Period as it struggled to secure enough timber to sustain a growing population on the eve of the industrial revolution. After examining two adaptive societies, the third case study looks at a modern state—the Democratic Republic of the Congo to see if any of the social and economic factors common in the other two cases are present in a state struggling with pressures from natural resources.

Summary

Malthusians and Optimists see both the causes and solutions to resource pressure differently. Malthusians see a world of finite resources and a definite limit to the number of people the planet can sustain. They recommend government intervention to both limit population growth and establish sustainable social and economic practices. These practices require governments to conduct broad and deep social and economic changes that are a cause of concern for many citizens, scholars and policymakers. Optimists on the other hand see economic solutions to resource scarcity and are proponents of minimal government intervention. As long as economic markets are open and competitive, scarce resources are signaled through higher prices which lead to new technologies and the use of alternative resources.

The arguments for both Malthusians and Optimists are summarized in Table 1 and used to construct a framework for examining societies that have adapted to resource scarcities. The framework looks at the role of individuals and governments in recognizing and responding to resource shortages. A number of economic and social factors are proposed for understanding commonalities between adaptive societies.

Chapter 2

The Byzantine Empire—Early Middle Ages

Charles Maurice and Charles W. Smithson argue the Greco-Romans experienced a natural resource shortage during the Early Middle Ages and managed to adapt by conserving resources. They base their argument on evidence from an ancient shipwreck discovered off the coast of Turkey which was the subject of a 1981 Public Broadcasting Associates documentary series titled "Ancient Mariners."[33] While the documentary focused on the role of nautical archeologists in the study of seafaring, Maurice and Smithson drew broader connections to natural resource scarcity and economics. The following is a brief summary of why this case study is considered an example of resource adaptation during the seventh century.

The Yassi Ada shipwreck was deemed a significant discovery because of the methods used to construct the ship's hull and frame. In earlier centuries, Greco-Roman shipwrights would first build the hull by fastening planks edge-to-edge with a series of mortise-and-tenon joints and then add the frame. Today, shipwrights first build a complete skeleton by adding frames to the keel and then covering the frames with planking. The Yassi Ada was built using a combination of both the old and newer construction methods. According to George Bass, "It [Yassi Ada] continued a trend, starting two or three centuries earlier, that reflected improved technology and also cut down the investment in labor and wood required to build hulls in the earlier Greco-Roman style."[34]

Although no one is certain why the Greco-Romans started modifying their shipbuilding methods, Maurice and Smithson argue a

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[33] Sam Low, "Ancient Mariners: Tales from an Ancient Ship," in *Ancient Mariners* (USA: PBS, 1981).

[34] George F. Bass, "Film Guide for Ancient Mariners, Tales from an Ancient Ship," in *Ancient Mariners*, ed. Sam Low (1981).

shortage of timber and/or labor in the Mediterranean caused the cost of building materials to rise. The increased cost of materials led Greco-Roman shipwrights to develop new building methods which conserved timber.[35] Although this theory might explain why the Greco-Romans adapted their shipbuilding methods, it does not explain how this process came about.

The central argument of this chapter is that the government was generally ineffective in solving natural resource pressures directly through policy and/or legislative efforts. Governments did however have an indirect but vital role in setting the social and economic conditions favorable for societies to adapt to natural resource shortages. In the following case study, the Byzantine government allowed citizens to own property, provided security, enforced the rule of law, and invested rents collected from resource extraction into infrastructure that facilitated some economy wide development and diversification. With these conditions in place, individuals emerged with innovative solutions that solved resource shortages.

This chapter will first explain the importance of timber to the Byzantine society in order to appreciate why this represented a significant adaptation to resource shortages. Individual social and economic freedom compared to government regulation and control is examined and a summary of the findings are included in Table 3.

The Importance of Timber Resources to Byzantine Society

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[35] Maurice and Smithson, *10,000 Years of Economic Crisis: The Doomsday Myth*, 95-100. The authors argue the discovery of three shipwrecks (Yassiada, Kyrenia and Serse Liman) and the differences in their construction methods indicate the Greco-Romans were experiencing a timber shortage between BC 300 and AD 1025. This shortage likely began in AD 600-625 since the Yassiada was built using a method requiring less labor and timber. Rising timber prices motivated shipbuilders to conserve timber and experiment with new construction methods.

Most of the land in Greece is mountainous with only 20-30% of the land suitable for farming.[36] Surface waters heat up to twenty eight degrees centigrade in the summer and the warm water is poor in nutrients—it is two to twenty times less rich in nutrients that support marine life than Atlantic waters in comparable latitudes.[37] The lack of nutrients for marine life made fishing a limited source of food for the Greco-Romans. Most Greek city-states specialized in crops that were suitable for their soils and depended on maritime commerce to supply grain and other resources from North Africa, Sicily and the Levant.[38]

Historically, the land in Greece had trouble supporting the population. During the Peloponnesian War, Attica could feed at best 75,000 people with barley. Their population was 250-300,000 and relied on grain shipments from Lemnos, the Ukraine and Crimea as Well as Cyprus and north Africa.[39] Robert Browning noticed in Herodotus' *Histories* a continuous theme throughout Greek history: how the poverty of the land had acted as a spur to the enterprise of its inhabitants.[40] The lack of food and other resources was alleviated by maritime commerce which required timber to both build and repair ships.

Some scholars consider timber the most important raw material during this period of Greek history.[41] It was prized for both the materials it provided and the functions it could perform. Wood materials were used to construct ships, tools, weapons, and buildings while iron, copper and tin were extracted from their metal ores using charcoal (charred

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[36] Thomas R. Martin, *Ancient Greece: From Prehistoric to Hellenistic Times,* (New Haven: Yale University Press, 1996), 1-2.

[37] Robert Browning, *The Greek World: Classical, Byzantine, and Modern,* (London: Thames and Hudson, 1985), 25-26.

[38] For specialized crops see: Martin, *Ancient Greece,* 2. For sources of food from maritime commerce see: Paul Cartledge, *The Spartans, the World of the Warrior-Heroes of Ancient Greece,* (New York: Vintage Books, 2004), 182.

[39] Cartledge, 182.

[40] Browning, *The Greek World,* 8.

[41] Browning, *The Greek World,* 33.

wood).[42] Michael Williams, emeritus professor of geography at the University of Oxford notes, "The importance attached to the supply of timber for building ships cannot be denied; ships were crucial to the burgeoning economic life of the Mediterranean, and sea power was vital in the exercise of political control."[43]

During the seventh century, the Byzantine fleet maintained ship repair yards in ports near pine or cypress covered slopes and the main shipbuilding center was Constantinople.[44] Along the shore of the Golden Horn, there were landing stages, quays, slipways, shipyards, and beaching slides used by the Byzantine navy, merchant vessels, and local ferries.[45] According to Browning, this period was also characterized by a slow shift from a society organized around half-autonomous cities—to one dominated by a single city—Constantinople.[46]

Government Control in Social and Economic Affairs

Constantinople, the main shipbuilding center and capital of the Eastern Roman empire during the seventh century, sits astride the land route from Europe to Asia and the sea route between the Black Sea and the Mediterranean. The city is protected by water on three sides—the Golden Horn to the north, the Bosporus Strait to the east and Lake Marmara in the south. Although this location afforded the city some natural protection from invading armies, infrastructure was needed to bring food and fresh water into the city. To pay for these projects, an elaborate tax system was put in place and the government used the revenues to develop and diversify the economy.

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[42] Stephen Haden-Guest et al., *A World Geography of Forest Resources,* (New York: The Ronald Press Company, 1956), 4-5.
[43] Michael Williams, *Deforesting the Earth: From Prehistory to Global Crisis, an Abridgment,* (Chicago: The University of Chicago Press, 2006), 71.
[44] Browning, *The Greek World,* 33.
[45] Edward Luttwak, *The Grand Strategy of the Roman Empire from the First Century A.D. To the Third,* (Baltimore: Johns Hopkins University Press, 1976), 70.
[46] Browning, *The Greek World,* 235.

Taxes and Expenditures on Infrastructure

The source of funds for government projects came from an elaborate tax system on land, agriculture and commerce. The land tax provided the bulk of revenue for the state and was assessed on agricultural land, farm stock and the rural population. An additional tax, the *chrysargyrum* or *collatio lustralis* was collected every four years and was imposed on "all who pursued trade everywhere, even on keepers of general stores in the cities, down to the poorest."[47]

The land taxes were based on periodic assessments of the agricultural yield of each tract of land (*jugatio*) and the available manpower (*capitation*). Because these taxes were "fixed" based on theoretical yields and not adjusted based on actual yields—poor harvests, droughts or floods meant these taxes could become a terrible burden during some years. After some poor harvests, farmers simply abandoned their homes and lands ahead of the tax collectors.[48]

The entire expenditures of the empire, from the cost of feeding and clothing the army and civil service, to the maintenance of the public transport system, the upkeep of the court, and maintenance of the food supply for the capital was entirely paid for by taxes on agriculture through the land tax. The wealth derived from agriculture was approximately twenty times that derived from industry and trade.[49]

Many of the city's emperors used the revenues collected from taxes on land and agriculture to build infrastructure that protected the city and aided the flow of economic goods and services. Some of these were the stone walls built along the western side of the city, the aqueducts and cisterns that supplied fresh water and numerous buildings to house administrators, merchants, craftsmen and government businesses.

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[47] A. H. M. Jones, *The Later Roman Empire, 284-602: A Social Economic and Administrative Survey*, [1st American ed. (Norman: University of Oklahoma Press, 1964), 872.

[48] Luttwak, *The Grand Strategy of the Roman Empire,* 201.

[49] Jones, *The Later Roman Empire*, 465.

In 324, Constantine I began construction of enormous stone walls on the west side of the city and the emperor Theodosius II, alarmed by the fall of Rome, expanded them in 413.[50] The walls were 30 feet tall and 16 feet thick. Although limestone mortar allowed the walls to sustain earthquake tremors, in 447 a powerful earthquake leveled fifty seven of the wall's towers and the city repaired the damage in a record sixty days while Attila the Hun lingered in the Balkans.[51] Although the Byzantine frontiers were frequently attacked during raids by the Visigoths, Persians, Avars, Arabs, and Huns, the shipwrights in Constantinople were protected by water and the western land walls for over a millennium.

The Emperor Valens ordered the construction of an elaborate network of aqueducts that carried fresh spring water into the city and allowed the city's population to grow to an estimated 375,000.[52] The aqueducts took thirty years to build and were 150 km in length. Additions to the network over the course of 100-150 years brought the total length of water channeled into the city to almost 400 km—it was considered one of the greatest achievements of hydraulic engineering known from antiquity.[53] The water from the aqueducts emptied into a giant cistern beneath the city—the largest one, the Basilica Cistern built during the reign of Justinian I, held 80,000 cubic meters of water.[54]

Emperors also used taxes to construct numerous buildings that housed government administrators and businesses as well as places to entertain citizens. Constantinople's stadium, the Hippodrome, was enlarged and numerous public baths, senate houses, churches and

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[50] Lars Brownworth, *Lost to the West: The Forgotten Byzantine Empire That Rescued Western Civilization*, 1st ed., (New York: Crown Publishers, 2009), 52.
[51] Luttwak, *The Grand Strategy of the Roman Empire,* 73.
[52] Warren Treadgold, *A History of the Byzantine State and Society,* (Stanford: Stanford University Press, 1997), 139.
[53] "The Water Supply of Constantinople." www.shc.ed.ac.uk/projects/longwalls/WaterSupply.html (accessed 28 April 2011).
[54] "Basilica Cistern." http://www.ibb.gov.tr (accessed 28 April 2011).

facilities for state businesses were constructed throughout the city's history.[55] The infrastructure protected property, allowed the city's population to grow and improved commerce with numerous buildings and shops to conduct business. The growing economic activity also gained the attention of the government.

Economic Control

According to Judith Herrin's history of the Byzantine period, there was "no doubt government wished to set profit margins and interest rates throughout the empire."[56] Products essential to the state could not be exported. From supplies of gold, salt and iron to wood for shipbuilding—anything that might aid the enemy could not leave the empire. In Constantinople, there was a determination to control all production—not just valuable silk and objects made of precious metals, but of candles, soap, fish and even notarial records.[57]

The state had its own factories and manufactured many of its own requirements. Arms and armor along with uniforms were manufactured in state factories. Marble needed for public works came from state quarries. Gold and silver for minting were extracted from state owned mines. Food for the army, civil servants and remainder of the population in the capital came from taxes on the land which were paid in the form of foodstuffs of all kinds.[58]

The government also controlled labor through contract laws. A law of Zeno prohibited builders and other craftsmen from refusing to work on contracts not completed by their fellow workers. If any of them did, it imposed penalties upon the heads of the respective guilds. There were also guarantees written into contracts that workers would not abandon

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[55] Treadgold, *A History of the Byzantine State and Society,* 39.
[56] Judith Herrin, *Byzantium: The Surprising Life of a Medieval Empire,* (Princeton: Princeton University Press, 2008), 151.
[57] Herrin, *Byzantium*, 150-151.
[58] Jones, *The Later Roman Empire*, 839.

work and if a member of the guild failed to complete a contract either willfully or due to sickness, a substitute would be provided.[59]

Concerning government control and regulation in the economy, Herrin concludes Byzantine merchants were hampered by restrictions and controls which limited their initiatives and imperial attitudes toward trade prevented the development of more flexible economic institutions. The Byzantines were more interested in building wealth through land ownership and purchasing government service positions than pursuing commercial activity.[60]

The Rule of Law and Protection of Property

Byzantine laws were clearly defined and enforced; however, there are some questions as to their fairness. During this period Roman law was completely recodified, police officers were appointed to enforce the laws, a standing army protected the land surrounding the empire and when rioters threatened to destroy the city of Constantinople, they were quickly subdued.

The complete recodification of Roman law since the rule of Constantine I was an ambitious project undertaken by the Byzantines. Justinian I aimed to produce an entirely new code by removing repetition and contradictions in the laws that had accumulated over a period of nearly 200 years. The *Codex Constitutionum* was produced in fourteen months and, on 8 April 529, became the supreme authority for every court in the empire.[61]

The code of civil law consisted of four books. The *Codex Constitutionum* contained all of the imperial laws updated for the conditions of the sixth century. The *Digest* recorded all the opinions and rulings of the court. The *Institutes* was a textbook that outlined the

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[59] Jones, *The Later Roman Empire*, 859.

[60] Herrin, *Byzantium*, 158-159.

[61] John Julius Norwich, *Byzantium, the Early Centuries*, 1st American ed., 3 vols., (New York: Knopf: Distributed by Random House, 1989), 196-197.

elements of Roman law and was designed to guide students. Finally, as emperors issued new laws, they were published in a separate book called the *Novels*.[62] Before the publication of the *Codex,* Roman women were severely restricted in owning property, were prohibited from inheriting and were subject to lifetime guardianship. The *Codex* proved to be the largest leap ever in the liberation of women.[63]

Although the legal system was fair in theory, there appeared to be questions about fairness in practice. A Byzantine ambassador visiting Attila's camp was surprised to meet a Greek living amongst the Huns. The man had been a merchant and prospered on the frontiers of the empire at Viminacium near the Danube. He had been taken prisoner and then set free but decided not to return to the empire because of the exorbitant taxes and abuses of the Roman courts. According to him, the rich could break the laws and avoid paying penalties but poor men who did not know how to "pull strings" incurred vast expenses as the legal process dragged on. Although there were some doubts about fairness, Jones argues, the majority of ordinary men, had confidence in the courts based on the low number of appeals.[64]

The Byzantines also established two chief law enforcement officers—a chief of police and a *quaesitor.* The chief of police was paid a salary and provided with 20 soldiers along with the necessary administrative staff. A second police officer, the *quaesitor* was added to control everyone who came to the capital. His duties were to find out the purpose of their visit, to expedite their business and to ensure they returned to their own provinces and cities without delay. In particular he was to see that peasants coming up to petition their landlords or bring an action against them returned to their farms with minimum

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[62] Herrin, *Byzantium,* 72.

[63] William Rosen, *Justinian's Flea: Plague, Empire, and the Birth of Europe,* (New York: Viking, 2007), 127.

[64] This story of the Greek living amongst the Huns is told by AHM Jones. See: Jones, *The Later Roman Empire,* 516-517.

delays. Able-bodied residents with no visible means of support were put to work on the public buildings or in the bakeries or guilds.[65]

The residents of Constantinople depended on food and other supplies from outside the city. To protect these resources and ensure access to the city by merchant shippers, the Byzantines maintained an army consisting of two types of forces. The frontier troops (*limitanei*) numbered approximately 195,000 soldiers and could be supplemented with 32,000 oarsmen who were assigned to the fleets. The other forces were field soldiers (*comitatenses*) who unlike the frontier forces, were largely barbarians and numbered approximately 104,000. Although they occasionally suffered defeats against Germans, Persians, and Huns, Warren Treadgold argued, they fought adequately under the command of loyal and capable commanders.[66] Although the field soldiers were dispatched throughout the empire, occasionally they were summoned to the city to quell rioters.

Upset with rising taxes, increased corruption and an overbearing emperor, a riot broke out in Constantinople that threatened to destroy the city. The mob stormed the city's prisons, convicts were freed, and women flung roof tiles and pottery from windows onto the heads of guards, set fire to shops, and burned a hospital to the ground with the patients still inside. With many of the rioters still in the Hippodrome, Belisarius (one of Justinian's generals) rounded up his soldiers and marched to the stadium. With the doors locked so no one could escape, Belisarius and his men slaughtered the crowd of about 30,000 in a matter of hours.[67]

The Extent of Individual Social and Economic Freedom

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[65] Jones, *The Later Roman Empire,* 692-695.

[66] Treadgold, *A History of the Byzantine State and Society,* 105.

[67] The best account of the Nika riots are told by Brownsworth. See: Brownworth, *Lost to the West*, 77-81.

Byzantine citizens were free to pursue specialized trades in the cities or practice agriculture in the countryside. Land ownership was the chief measure of wealth and used to determine an individual's tax obligation to the emperor. Although land ownership provided stability, punitive taxes added some instability as those who were unable to pay their taxes simply abandoned their farms and went to work for other land owners.

Trades tended to be hereditary—fathers trained their sons in their own crafts but it was a matter of custom rather than law. Craftsman were organized in guilds (*collegia*) and were used by the local and imperial authorities to collect taxes and perform compulsory services of various kinds—from cleaning drains to fighting fires.[68] Unlike the guilds of craftsmen in Rome, craftsmen in Constantinople were free to pursue new trades, enlist in the army or migrate to the country to take up agriculture.[69]

Land throughout the empire was either owned by absentee landlords or peasant proprietors. The absentee landlords were government administrators and members of the professional classes who resided in the cities. They rented their lands to peasants who grew crops and raised livestock. Absentee landlords collected rents to supplement their government wages and the renters paid taxes on the theoretical yields the land could produce. Peasant proprietors owned their land and were required to pay the land taxes only. They tended to be small and got smaller from generation to generation as their land was divided among heirs.[70]

Taxation was not uniform for all classes and periodic assessments to determine the land taxes favored the large estates owned by the absentee landlords. Those with influence obtained reduced rates and

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[68] Jones, *The Later Roman Empire,* 858-859.
[69] Jones, *The Later Roman Empire,* 861.
[70] Jones, *The Later Roman Empire,* 773.

laid the burden of taxes on their small neighbors. A succession of bad harvests, barbarian raiders ravaging crops and carrying off animals could destroy the small landowners and renters. If they couldn't sell their land to pay their taxes, they simply abandoned them and sought employment with a majority landowning neighbor.[71]

Summary

Timber was a crucial resource from antiquity to the middle ages. By the early seventh century the Greco-Romans were building ships using new methods to try and conserve timber. The Byzantine government did not take any action to conserve these resources or encourage the adaptation of new construction methods. The government did, however, facilitate adaptation indirectly by providing the necessary social and economic conditions so that Greco-Roman shipwrights could find solutions to their own resource shortages.

The Byzantine government allowed citizens to own property, provided security, enforced the rule of law, and invested rents collected from resource extraction into infrastructure that facilitated some economy wide development and diversification. With these conditions in place, individuals emerged with innovative solutions that solved their own resource shortages.

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[71] Jones, *The Later Roman Empire,* 770-774.

Table 3: A Summary of Social and Economic Factors in Byzantium

Agency	Economic Factors	Social Factors
Individual	Unlike the guilds in Rome, individuals in Constantinople were free to pursue any specialized trade of interest: Guilds (collegia) Merchants Craftsmen Specialized Agriculture Builders Government regulation and control hindered merchant initiative	Shipwrights working in Constantinople were likely responsible for "discovering" the new construction methods During the two centuries examined, Constantinople was protected from foreign invasion/war and to some extent the surrounding countryside was protected by the Imperial Army and Navy One major instance of widespread violence (Nika Riots) were quickly quelled
Government	In Constantinople govt. attempted to control all production and exercised strict export controls on essential items Land or "food" taxes were based on theoretical agricultural yields from surveys conducted every 5 years Taxes collected from agricultural production were invested in infrastructure projects inside the city of Constantinople Theodosian Land Wall protected the cities western flank from invasion The Basilica Cistern was a large public water works project that ensured the city could stay supplied with fresh water The aqueducts were another public water works project that ensured fresh water could be drawn into the city from the surrounding countryside	No evidence of direct government involvement in identifying or responding to resource pressures This period marked the first attempt at clarifying several centuries worth of contradictory and confusing laws into a single code (Justinian Codes) The fairness of some laws are questionable Laws were enforced through an extensive network of administrators, judges and police officers Protection of Property: Each city had a police officer Officials were authorized to enlist forces when riots/lawlessness broke out Fire Brigades were provided. When needed, the guilds performed fire-fighting services An Army and Navy was maintained through conscription at first and later by recruiting volunteers

Source: Author's Original Work

Chapter 3

England—Early Modern Period

During the sixteenth and seventeenth century, England experienced chronic timber shortages and the government took steps to conserve their forests. Although the policies put in place were ineffective, the government did have an indirect role in setting the social and economic conditions favorable for its citizens to adapt to natural resource shortages. In the following case study, the English government recognized the right to own property, provided security, enforced the rule of law, and encouraged economy-wide development and diversification through favorable economic policies. With these conditions in place, individuals emerged with innovative solutions that solved England's resource shortages.

This chapter will first explain what caused the resource shortage, the government's attempt to conserve resources and the processes that led to the substitution of coal in place of wood in the production of iron. The degree of individual economic and social freedom along with the degree of government control is examined with respect to the framework in Chapter 2. A summary of the social and economic factors identified in this study is provided in Table 4.

The Evolution and Resolution of England's Timber Shortage

England's timber shortages were caused by population growth, the rise of industry, demand for arable land and at times, the government. Although the government shared in the blame for causing the shortages, it attempted to limit timber consumption through acts of parliament. These policies, however, were ineffective and by the early eighteenth century, the English had discovered how to substitute wood with coal to smelt iron. An English citizen made this discovery while experimenting

with contemporary methods without direct assistance from the government.

Although estimates vary, the population of England and Wales rose from approximately two million in the middle of the fifteenth century to over nine million by the end of the eighteenth century.[72] During the 44 year reign of Queen Elizabeth, the population of England was estimated to have increased by as much as 35% at the time of her death in 1603.[73] In addition to native population growth, refugees from the Netherlands flocked to England in large numbers from the mid-1560s and many of them were skilled craftsmen who boosted new industries.[74]

The growing population required more food and forests were cleared to open up land for both cultivation and pasture. This also made room for cities and villages to expand.[75] C.W. Pearson argued it even brought people together who had been separated by the presence of extensive forests across the island for centuries, "gradually transforming England into one land inhabited by one people."[76]

In addition to demand for arable land, industry consumed large quantities of forests. The best trees for shipbuilding were one hundred year old oaks and it could take as many as 4,000 of these trees to build a single British man-of-war.[77] The iron, lead, tin, and copper industries consumed large tracts of forests—each furnace burned the equivalent of

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[72] James E. McClellan and Harold Dorn, *Science and Technology in World History,* (Baltimore: Johns Hopkins University Press, 1999), 278.

[73] D.M. Palliser, *The Age of Elizabeth: England under the Later Tudors 1547-1603*, Second ed., (New York: Longman, 1992), 43.

[74] Palliser, *The Age of Elizabeth*, 25.

[75] Paul Sears, a botanist and at one time Chairman of the Natural Resources Committee for the National Research Council during the 1950s recognized what he called a "two-mindedness" of the forest—timber was prized for materials but at the same time viewed as a rival for the space needed for "crops and flocks." See: Haden-Guest et al., *A World Geography of Forest Resources*, 4.

[76] Robert Greenhalgh Albion, *Forests and Sea Power: The Timber Problem of the Royal Navy 1652-1862,* (Cambridge: Harvard University Press, 1926), 121.

[77] H.C. Darby, ed., *A New Historical Geography of England,* (New York: Cambridge University Press, 1973), 273. See also: McClellan and Dorn, *Science and Technology in World History*, 279.

four square kilometers of woodlands every year.[78] The production of glass, pottery, brick, and tiles as well as brewing and the manufacture of lie and dyestuffs required an expansion in the use of wood for fuel.[79]

Population growth, the rise of industry and demand for arable land were not solely to blame for the shortages. Robert Albion, in his study of the Royal Navy's constant concern with the shortage of timber, argued the beginning of England's timber shortage began in 1535 during the reign of Henry VIII after he confiscated the property of the Roman Catholic Church. Most of the churches owned woodlands and the oak trees were one of the most readily negotiable parts of the confiscated property. Selling grants to cut timber was a quick way to add funds to the royal bank account. According to some records, there were more oak trees cut down during each of the last twelve years of Henry VIII's reign, than had been harvested during the entire previous half century.[80]

When the growth rate of timber could not keep up with the rate of consumption, prices rose as supplies were depleted. Between 1500 and 1700, the price of firewood rose tenfold while general prices rose fivefold.[81] State papers were filled with apprehensions and complaints about the loss of woodlands and writers voiced their growing concerns with the destruction of the woods of Sussex, Dean, west Midlands, North Wiltshire, Blackmore and Arden.[82]

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[78] McClellan, *Science and Technology in World History,* 279.

[79] Haden-Guest et al., *A World Geography of Forest Resources*, 4-5.

[80] Albion, *Forests and Sea Power*, 122.

[81] McClellan, *Science and Technology in World History,* 279. Some scholars have attributed the rise in prices during this period to the discovery of new sources of silver and gold from Central and South America. The introduction of enormous sums of silver and gold from the New World to the Old World caused prices to rise in Spain first and then England, through the cloth trade concentrated in Antwerp—the financial center of the Spanish Empire. See: G.R. Elton, *England under the Tudors*, ed. Sir Charles Oman, VIII vols., vol. IV, A History of England, (New York: G.P. Putnam's Sons, 1954), 228.

[82] A.L. Rowse, *The England of Elizabeth: The Structure of Society,* (New York: Macmillan, 1951), 67.

The naval struggle with Spain also focused the Crown's attention on the problem of ship timber. The commander of the fleet that defeated the Spanish Armada, Lord Howard of Effingham, protested to Queen Elizabeth against her selling grants to cut timber, and said that he was "grave to think of the state her woods are now in and what want there is for building and repairing her ships which are the jewels of her kingdom."[83]

The Crown attempted to limit its consumption through Acts of Parliament but the need for money, combined with government corruption, made these measures ineffective. Edward VI attempted to limit timber harvesting along the Thames to preserve the supply of naval timber for Deptford Yard.[84] During the middle of Elizabeth's reign, concerns over the nation's timber supplies were captured in an act of parliament in 1570. The legislation attempted to strengthen the timber conservation provisions of an earlier act passed in 1543 that preserved ship timber near the coast.[85] Additional laws attempted to limit forging and furnace operations in districts where timber was scarce.[86] Although the Crown tried to conserve timber, the royal coffers were short on funds and grants for cutting rights were granted as a quick way to secure additional capital.[87]

Despite the government's best efforts to address these problems, A.L. Rowse comments, "The effectiveness of government was limited in those days."[88] Maurice and Smithson cite evidence of possible

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[83] Albion, *Forests and Sea Power,* 24.

[84] Albion, *Forests and Sea Power,* 123.

[85] Albion, *Forests and Sea Power,* 123.

[86] Nathan Rosenberg, "Innovative Responses to Materials Shortages," *The American Economic Review* Vol. 63, no. 2 (1973), 112.

[87] During Elizabeth's reign, Duffield Forest had 59,412 large oaks and 32,820 small oaks in 1560. By 1587, there were 2,864 large oaks and 3,032 small oaks. In St. Leonards Forest in Sussex, 1 million cubic feet of timber were cut on Royal licenses in 20 years. In spite of a large amount of timber available for sale—prices more than doubled during the period. See: Albion, *Forests and Sea Power,* 123.

[88] Rowse, *The England of Elizabeth,* 81.

corruption when, "The Countess of Rutland in 1584 complained to the Crown that wood promised her from Sherwood Forest had not been delivered. The Queen's minister, Burghly, pointed out the Countess had already received warrants for 420 trees and thought that this was a large number of trees for the repair of only the castle and mills."[89] As the government tried to conserve timber through acts of parliament, efforts were made to find a substitute.

Substituting wood with coal presented several technological challenges—most of them were due to the chemical by-products from combustion. Burning coal produced sulfur, which ruined bread, beer, glass, and other products when they came into direct contact with the gas.[90] The smell of sulfur was also obnoxious and for this reason wood was preferred for heating homes and lighting buildings. Glass makers were the first craftsmen to use coal as a substitute for charcoal in the early seventeenth century.[91] Eventually, coal was substituted in almost every industry with the exception of iron production. In 1709, Abraham Darby, a Quaker ironmaster, succeeded in using coke (charred coal) instead of wood charcoal in the blast furnace to smelt iron ore. He made this discovery through tinkering with contemporary methods—organized institutional science did not play any role in his discovery.[92]

Ultimately, the English ended up substituting coal, a more abundant resource, for timber and by the latter part of the seventeenth century, almost all British homes were heated with coal and it was the primary source of energy for almost every industry except iron smelting.[93]

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[89] Maurice, *10,000 Years of Economic Crisis*, 77.
[90] McClellan, *Science and Technology in World History,* 279.
[91] Rowse, *The England of Elizabeth,* 115.
[92] McClellan, *Science and Technology in World History,* 280.
[93] Maurice, *10,000 Years of Economic Crisis*, 79.

Government Control in Social and Economic Affairs

England's response to resource scarcity during the sixteenth and seventeenth centuries and the substitution of a more plentiful resource occurred against a backdrop of social and economic conditions that were favorable to adaptation. English citizens enjoyed economic freedom and the government exercised control that was limited to economic development.

Taxes and Expenditures

The English were the least taxed of any nation in Europe.[94] When taxes were collected, they only affected 60% of the adult male population and eventually by the end of the sixteenth century, only one in twelve houses paid any direct tax at all. Although these policies were good for the English citizens, they made it difficult for the Crown to maintain a standing army.

No parliament voted for taxes to maintain a standing army beyond the needs of wartime. The Crown was expected to rely on income from the Crown lands, customs, legal fees and Church benefices.[95] A.L. Rowse found it remarkable "in spite of the considerable expense of the Franco-Scottish war, of forces on the Border and in Ireland, of the Northern Rising and the tension with Spain, taxation was held low and Parliament was not called on to aid the Crown."[96] Gradually, taxation was collected in peacetime as well.[97] Money collected from taxes paid for several projects that improved commerce.

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[94] Palliser, *The Age of Elizabeth*, 14.
[95] Palliser, *The Age of Elizabeth*, 14.
[96] Rowse, *The England of Elizabeth,* 328.
[97] Palliser, *The Age of Elizabeth*, 14.

In 1600 an act was passed which set in motion the draining of marshlands in eastern England to create land suitable for agriculture.[98] Improvements were also made to deepening and straightening rivers to make them more navigable. New channels were cut and coastal works were undertaken to improve the harbors and ports.[99]

Economic Regulation

The government took an active role in England's economic development through foreign trade policies designed to maintain a positive balance of trade. According to Rowse, England was essentially a large free-trade area compared to other states.[100] In Germany and France, tolls along the Rhine and the Loire restrained trade while in England, raw materials and finished goods moved along England's rivers and trade routes toll free.[101] Travel by sea was also free of tolls and most of England's traffic was coastwise.[102] In addition, the government did everything in its power to encourage the change-over from a more primitive economy based on agriculture and the export of raw materials to a more advanced economy based on the export of manufactured goods.[103] The transition from an agrarian economy to a manufacturing economy was accomplished in part through issuing licenses and patents to encourage invention and innovation.

The government encouraged economic development and diversification by issuing licenses and/or patents and monopolies to

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98 This is often referred to as the "Draining of the Fens," see: Rowse, *The England of Elizabeth*, 68.

99 Palliser, *The Age of Elizabeth*, 69.

100 Rowse, *The England of Elizabeth,* 113.

101 Rowse, *The England of Elizabeth,* 113.

102 Rowse, *The England of Elizabeth,* 113.

103 During the 16th Century, the English cloth trade at Antwerp formed the bulk of the state's exports. According to Rowse, the Tudor government did everything in its power to encourage the change-over from exporting raw wool and unfinished cloth to exporting manufactured wool products. This change-over was intended to develop and retain a larger share of the international wealth in England. See Rowse, *The England of Elizabeth,* 116.

encourage inventors and entrepreneurs to develop new products or processes. These licenses were intended to foster product innovation and import substitution by allowing inventors the sole manufacture of a new product or the sole use of a new technique. Skilled foreigners were encouraged to move to England and pass on their skills to natives. The government rewarded them with short-term patents of monopoly. Edward and Elizabeth encouraged "projectors," native inventors of new processes, by granting them patents also. According to D.M. Palliser, these measures of protection were largely successful and beneficial to the economy in helping England achieve their goals of self-sufficiency by 1600.[104]

The Rule of Law and the Protection of Property

The government during this period had no standing army or state police and only a rudimentary bureaucracy. As Palliser notes, "it made for a situation of government by the informal mechanism of consent."[105] The government was obsessed with the fear of revolts, riots, and armed assaults and the ownership of armor and weapons were widespread and required by statute as a means of local defense against invasion or rebellion.[106] Although the state lacked a standing army or police force, it appeared there was no need for one.

> English society was intensely "law−minded," obsessed with legal considerations, legal rights and legal remedies. Even the mutual obligations of the family were put into legal form…society rested immediately upon the law as administered in the courts, but the routine buying and selling of land was also effected through a court…Contracts, agreements, liabilities to the monarch, all had to be expressed as obligations of debt. The government of the

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[104] Palliser, *The Age of Elizabeth*, 376.
[105] Palliser, *The Age of Elizabeth*, 351.
[106] Palliser, *The Age of Elizabeth*, 360.

country was, at all levels, effected through the legal system.[107]

The innate law–mindedness of the English and rule by consent led to stability that continental Europe lacked. Rowse compared the French state, with its military forces and bureaucracy, against the English state, with no standing army and the voluntary service of its subjects and wrote:

> On the continent the medieval system of local government gave way to a highly centralized bureaucratic regime. With the disappearance of the medieval system there disappeared also those ideas of the supremacy of the law and of local self government which were inherent in it. The people at large had nothing to do with it the government except obey its orders. Criticism was not tolerated; and they gradually ceased to take an intelligent interest in its conduct. When the burden came to be too heavy the only recourse was revolution. English government was in contrast to this– continuity, a regard for the rights of small as well as great, and grafting of new institutions upon old. No instance is remarkable than trial by jury an institution characteristically Frankish that became in time peculiarly English and had already by the end of the Middle Ages become a theme of national pride. The French however–there was no jury and torture was freely employed.[108]

The English had a clear and well-defined legal system that was considered very effective for the times. Respect for property, adherence to the rule of law and consent by the governed were some of the conditions that brought stability to English society during this period.

Individual Economic and Social Freedom

Englishmen were free to pursue their own economic self interests and enjoyed social mobility. There was individual ownership of property, a market economy, the profit motive, the area over which they traded expanded and the country saw considerable political, economic and

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[107] Palliser, *The Age of Elizabeth*, 360.

[108] Rowse, *The England of Elizabeth,* 361-362.

social integration.[109] This was possible due in large part to changes made in land ownership. The English transitioned from farming the land in commons or "open fields" to one in which the land was "enclosed" to produce agricultural profits.

Prior to this time, most of the English countryside was open–cultivated by villagers based on a common system of agriculture called *open fields* in which everyone held strips and patches.[110] This system of farming was practiced over much of the country for the greater part of 2000 years. C.S. Orwin offers one of the best descriptions of this practice in his book, *The Open Fields.* It is described as a system in which all the cultivatable land was divided into approximately three equal fields. In one field, corn or wheat was planted in the fall, in another field, barley was planted in the spring, and the third field rested in fallow. The system of cultivation rotated, so crops would not exhaust the nutrients in the soil. The division of each farmer's land into multiple strips, distributed evenly over the open fields was designed to give each person his fair portion of both the good and less good soil as well as access to the near and more remote parts of the field. After harvesting the corn crop, and cutting the meadows, the fields were thrown open to all farmers alike to graze their stock for a season.[111]

The open field practice of farming eventually gave way to the practice of enclosure or separating the fields in to various plots worked by their individual owners.[112] Economic historians refer to what was happening in these times as the "commercialization of agriculture." The abandonment of subsistence agriculture for one geared to the market meant land could be devoted to the crops that grew best and more

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[109] Palliser, *The Age of Elizabeth*, 6.
[110] Rowse, *The England of Elizabeth,* 66.
[111] C.S. Orwin, *The Open Fields*, Third Edition ed. (New York: Oxford University Press, 1967), 1.
[112] Rowse, *The England of Elizabeth,* 67.

efficiently.[113] Improved methods of farming produced larger yields which sustained England's growing population. Commercialized agriculture provided a tremendous incentive for more efficient cultivation across the country and improvements to farmland in general. As Rowse observed, "men will do for and with their own property what they will not do for others."[114] England was so successful with commercialized agriculture by the end of the sixteenth century some argued the country was in a position to feed other nations and farmers rivaled manufacturers and merchants in their prosperity.[115] The transition to commercialized agriculture freed much of the population to pursue other interests which afforded them some degree of social mobility.

D.M. Palliser found there was abundant evidence of mobility into and out of all social levels—downwards as well as upwards.[116] The degree of social mobility allowed:

> The son of a tradesman in a small midlands town to end up owning the largest house there, a coat of arms, and the appellation "William Shakespeare of Stratford-upon-Avon, gentleman," or in an earlier and more extreme case, the son of a Putney cloth worker to become Thomas Cromwell, Earl of Essex and Lord Privy Seal.[117]

Social mobility and economic freedom came about after changes were made from open fields farming to one in which individual's owned their own land. When the land was enclosed, individuals made improvements to their land which increased agricultural yields. The excess food supplies allowed people to abandon subsistence agriculture and pursue specialized trades in the cities.

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[113] Rowse, *The England of Elizabeth,* 71.
[114] Rowse, *The England of Elizabeth,* 110.
[115] J.B. Black, *The Reign of Elizabeth 1558-1603*, ed. G.N. Clark, XIV vols., vol. VIII, The Oxford History of England (Oxford: Clarendon Press, 1936), 212.
[116] Palliser, *The Age of Elizabeth*, 98.
[117] Palliser, *The Age of Elizabeth*, 99.

Summary

Natural Resource shortages were recognized in sixteenth and seventeenth century England and the government took steps to conserve resources. Although the policies put in place were ineffective, the government did have an indirect role in setting the social and economic conditions favorable for its citizens to adapt to natural resource shortages. The English government recognized the right to own property, provided security, enforced the rule of law, and encouraged economy-wide development and diversification through favorable economic policies. With these conditions in place, individuals emerged with innovative solutions that solved England's resource shortages.

Table 4: A Summary of Social and Economic Factors in England

Agency	Economic Factors	Social Factors
Individual	Individuals were free to pursue their own economic self-interests Enclosures led to more efficient agriculture which allowed some to abandon farming and pursue specialized trades	Individuals did notice decreasing supplies of timber but there was no written evidence of individual efforts to conserve timber Abraham Darby succeeded in using coke (charred coal) instead of wood charcoal in the blast furnace to smelt iron ore. Organized institutional science did not play any role in the discovery English citizens enjoyed social mobility The ownership of armor and weapons was widespread—they were required by statute as a means of local defense against invasion or rebellion
Government	Government took active measures to encourage trade and development (Mercantilism) Patents and monopolies were issued to encourage inventors and entrepreneurs to develop new products and processes Skilled foreigners were encouraged to move to England to pass on their skills to natives Revenues were invested in improvements that aided commerce The Draining of the Fens Dredging waterways Improvements to ports Government regulation was kept to a minimum internal trade along England's rivers were free of tolls unlike France and Germany Taxes were kept to a minimum—the Crown relied on rents from lands, customs, and legal fees No parliament voted money to maintain a standing army beyond the needs of wartime	Government did identify the resource shortages and passed laws to limit their consumption but the laws were ineffective Government did not have a direct role in the discovery of substitutes—it likely had an indirect role by issuing patents which motivated inventors and entrepreneurs English society was intensely law-minded Even the mutual obligations of the family were put into legal form The government of the country at all levels was effected through the legal system

Source: Author's Original Work

Chapter 4

The Democratic Republic of the Congo

This chapter examines the social and economic conditions in the modern day Democratic Republic of the Congo (DRC). In the DRC, there is less individual freedom and more government control as the state struggles with pressures from its natural resources. Property rights are not protected, social mobility is limited, the largest industry is predominantly state owned, businesses are over-regulated and taxed, and revenues collected from resource extraction are not invested in infrastructure to develop and diversify the economy.

According to the United States Agency for International Development (USAID), the Congo has a 200-year history of significant migration as people moved to take advantage of natural resources and escape frequent outbreaks of violence.[118] Today, the DRC is ranked number five on the Fund for Peace Failed States Index and, out of 177 countries, has the worst demographics—one of the twelve indicators used to measure state failure.[119] Half the population is under the age of fourteen, and the annual population growth is a quick 3% despite civil war, a high infant mortality rate, and pervasive infectious disease.[120] By most measures, the DRC is struggling to adapt to pressures from its natural resources.

Unlike the previous cases, the Congo has an abundant supply of resources; but, years of conflict have displaced people into fragile ecosystems and degraded many of their natural resources. Congolese encroach on protected forests to grow food, obtain fuelwood and hunt

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[118] USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo." http://usaidlandtenure.net/usaidltprproducts/country-profiles/democratic-republic-of-congo/country-profile-democratic-republic-of-congo, 5. (accessed 3 May 2011).

[119] "The Failed States Index 2010," *Foreign Policy* Jul/Aug 2010.

[120] "The Failed States Index 2010," *Foreign Policy* Jul/Aug 2010.

game to sustain their families, while militias illegally exploit natural resources to buy weapons and commit human rights violations in areas under their control.[121] Local institutions that had traditionally governed access to natural resources according to tribal customs and practices were ruined by large numbers of displaced persons and resources were overused and looted.[122]

The international community has invested billions of dollars to restore security and governance in the DRC, including over $500 million to draft a new constitution and elect a new administration.[123] But according to Seth Kaplan,

> this effort to usher in stability, accountability, and democracy has already begun on a formula inappropriate to the country's conditions. The latest international effort to fix the DRC prescribes conventional remedies for failed states—elections, economic liberalization, and security reforms—all of which are desirable but none of which will make a significant difference unless coupled with an ambitious plan to counteract the systemic roots of the country's profound dysfunctionalities.[124]

The "profound dysfunctionalities" Kaplan speaks of are reconciled through what he and others refer to as a "bottom up" strategy.[125] In a similar vein, Severine Autesserre argues Western diplomats, United Nations peacekeepers and nongovernmental organizations, viewed the local conflicts in the Congo as the result of insufficient state authority and favored organizing elections as the preferred method to state

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[121] For encroachment see: USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo," 12. For militias and illegal natural resource extraction see: US State Department, "Background Notes: Democratic Republic of Congo." US Department of State, 6.

[122] USAID, "Property Rights and Resource Governance, Democratic Republic of Congo." 4.

[123] Seth D. Kaplan, *Fixing Fragile States.* Westport, CT: Praeger Publishers, http://www.praeger.com. (accessed 4 May 2011).

[124] Kaplan, *Fixing Fragile States,* 1.

[125] Kaplan, *Fixing Fragile States,* 10-16.

building instead of more effective locally based approaches.[126] When you consider the Congo is approximately the same size as all of western Europe and has little infrastructure, it is easy to understand why any top-down, centrally directed, strategy to deal with pressures from natural resources is flawed. In the previous case studies, the solutions to the state's resource challenges came from individuals working independently of any government organized or directed effort. Whether the Congo can break from this historical trend remains to be seen.

The DRC possesses many natural resources and substantial mineral wealth. It was once the leading source for industrial diamonds worldwide and has one of the world's greatest concentrations of copper, cobalt, and coltan (85% of global reserves). Uranium for the first US atomic bomb was also mined in the DRC.[127] Despite these endowments, poor resource governance has been both the cause and result of conflict, instability, and poverty in the DRC for more than a century.[128] Between 1998 and 2007 more than 5 million Congolese died from violence, famine, and disease while armies, warlords, and assorted gangs pilfered hundreds of millions of dollars in gold, diamonds and coltan.[129]

Individual Social and Economic Freedom

The Congolese do not enjoy social and economic freedom. Property rights are not upheld and subsistence agriculture prevents many Congolese from pursuing specialized skills and trades. Physical insecurity threatens economic stability.

Since 1966, the DRC has had a series of laws stripping away land and property rights from the Congolese citizens and granting exclusive

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[126] Severine Autesserre, *The Trouble with the Congo: Local Violence and the Failure of International Peacebuilding* (New York: Cambridge University Press, 2010), 11.
[127] Kaplan, *Fixing Fragile States,* 4.
[128] USAID Country Profile, "Property Rights and Resource Governance: Democratic Republic of Congo." 2.
[129] Kaplan, *Fixing Fragile States,* 1.

ownership to the government.[130] Under the current Constitution and the DRC's 1977 Expropriation Law, the state owns all the land in the DRC and has the power to confiscate land it deems necessary for either public use or in the public interests.[131] Despite a new constitution and better attempts at enforcement, protection of property rights is weak and dependant on a dysfunctional public administration and judicial system.[132]

In the 1970s, the state used its power of expropriation to evict indigenous communities from forestland. Three thousand to 6,000 Batwa families from the Kahuzi-Biega forest were removed without payment of compensation to the families who lost their land. According to USAID, the current frequency and nature of government land expropriations, and the extent to which the government abides by the legislated procedures are unknown.[133]

Agriculture is the mainstay of the Congolese economy and accounts for 42.5% of their GDP.[134] Commercial agricultural production is limited because many producers are engaged in subsistence food production. Agriculture does not produce enough food to meet the country's needs and the DRC must import 11% of its cereal grains.[135]

Subsistence agriculture hinders social mobility. There is no middle class.[136] 71% of the population is below the poverty line.[137]

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[130] Dorina Bekoe and Michelle Swearingen, "What Next for the Democratic Republic of Congo? Recommendations from a Trans-Atlantic Diaspora Dialogue," 8.
[131] USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo," 6.
[132] "2011 Index of Economic Freedom." www.heritage.org/index/Country/DemocraticRepublicCongo, (accessed 27 April 2011).
[133] USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo." 3.
[134] US Department of State, "Background Notes: Democratic Republic of Congo."
[135] USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo," 4.
[136] Bekoe and Swearingen, "What Next for the Democratic Republic of Congo? Recommendations from a Trans-Atlantic Diaspora Dialogue," USIPeace Briefing (December 2009), 10.

An estimated 80% of the population of 64 million lives on less than US $1 per day.[138] Fighting, banditry, and abuses of human rights threaten security and deter economic activity.[139]

Government Social and Economic Control

Despite recent attempts to improve the economic climate, the government still exercises considerable social and economic control. Due to financial mismanagement and corruption, state revenues are not invested in infrastructure to develop and diversify the economy

Taxes and Expenditures

According to research by Dorina Bekoe and Michelle Swearingen, a business owner is required to make 32 different tax payments per year, which can end up costing over 322% of their profit.[140] The Economic Freedom Index listed the DRC with a moderate income tax rate and a relatively high corporate tax rate. The former top rate is 30% and the latter is 40%.[141]

Despite the state's vast natural resources and mineral wealth, infrastructure is poor to nonexistent. The country has 2,344,858 square kilometers of land and only 153,497 km of roads. Of those only 2,794 km are paved.[142] There are 150 power outages each year—one of the worst records in Africa.[143] In addition to poor roadways and inadequate reliable power generation, the telephone fixed-line infrastructure is "wholly inadequate." The state-owned operator provides less than 1

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[137] CIA World Factbook, "The Democratic Republic of the Congo, 2009." Central Intelligence Agency, https://www.cia.gov/library/publications/the-world-factbook/index.html, (accessed 27 April 2011).

[138] USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo." 3.

[139] "2011 Index of Economic Freedom," The Heritage Foundation & The Wall Street Journal, www.heritage.org/index/Country/DemocraticRepublicCongo, (accessed 1 June 2011).

[140] Bekoe, "What Next for the Democratic Republic of Congo," 9.

[141] "2011 Index of Economic Freedom," www.heritage.org/index/Country/DemocraticRepublicCongo, (accessed 1 June 2011).

[142] CIA World Factbook, "The Democratic Republic of the Congo, 2009."

[143] Bekoe, "What Next for the Democratic Republic of Congo," 9.

fixed-line connection per 1000 persons and only 1 in 10,000 Congolese is an internet user.[144] Although the DRC collects taxes from businesses and individuals, the poor condition of its infrastructure is a sign to many scholars that these revenues are being mismanaged.

Economic Regulation

The DRC's economy is dominated by the mining sector and the state owns the largest mining operation—Gecamines.[145] According to the US State Department, Gecamine's production of minerals has been severely affected by corruption, civil unrest, world market trends and failure to reinvest.[146] Corruption is rampant and government policies have led to a parallel economy. Individuals and small businesses operating in the formal economy suffer high costs under arbitrarily enforced laws and as a result, the informal economy dominates the economy.[147] This development makes it difficult to develop larger, more integrative markets that "promote entrepreneurship, maximize wealth creation and allow the country to achieve full employment."[148]

Rule of Law and the Protection of Property

The DRC legal system suffers from widespread corruption, unreliable administrators and the complicated legal code is enforced selectively.[149] As a result, there are two legal systems. The formal laws tend to apply in the urban areas and to large holdings of productive land in the rural areas only.[150] The informal, or customary laws, apply in the rural areas. Under customary law, clans and small groups hold land

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144 CIA World Factbook, "The Democratic Republic of the Congo, 2009."
145 US Department of State, "Background Notes: Democratic Republic of Congo."
146 US Department of State, "Background Notes: Democratic Republic of Congo."
147 US Department of State, "Background Notes: Democratic Republic of Congo."
148 John Mukum Mbaku, "Entrenching Economic Freedom in Africa," *Cato Journal* 23, no. 2 (2003), 222.
149 "2011 Index of Economic Freedom." www.heritage.org/index/Country/DemocraticRepublicCongo, (accessed 1 June 2011).
150 USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo," 6.

collectively while Chiefs allocate use-rights to individual plots of land. According to USAID, "chiefs granting land-rights are issuing a type of concession document but there are no established forms and no procedures for recording the documents."[151] In addition to a complicated and corrupt legal system, the laws—if and when they are applied—are not done so equally.

The DRC Constitution that went into force in 2006 provides for equality of women and prohibits discrimination on the basis of sex; however, many of the country's formal laws continue to discriminate against women.[152] If a married woman wants to purchase or lease land, open a bank account or accept a job—she must ask for her husband's permission.[153] Even though many women have decision-making authority over the planting and harvesting of crops on the lands allotted to them, they are not considered owners of the land.[154]

Summary

In the DRC, there is less individual freedom and more government control as the state struggles with pressures from its natural resources. Property rights are not protected, social mobility is limited, the largest industry is predominantly state owned, businesses are over-regulated and taxed, and revenues collected from resource extraction are not invested in infrastructure to develop and diversify the economy. The DRC does not exhibit any of the social and economic factors identified with successful adapters in the previous cases. Bottom up strategies focused on the development of individual economic freedom and stability

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[151] USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo," 7.
[152] USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo," 7.
[153] USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo," 7.
[154] USAID Country Profile, "Property Rights and Resource Governance, Democratic Republic of Congo," 7.

through limited local governance could be more effective after examining the historical evidence from adaptive societies.

Table 5: A Summary of Social and Economic Factors in the Democratic Republic of the Congo

Agency	Economic	Social
Individual	Property Rights are not secure Majority practice subsistence agriculture is the largest employment source -inadequate to feed entire population	No Middle Class -71% are below the poverty line Very little stability especially in the eastern portion of the country
Government	Largest industry is state owned Restrictions on imports, complex regulations, heavy tax burdens on businesses Revenues are not invested in infrastructure Limited telephone service Poor road conditions Electric power generation is inadequate	Legal system is confusing and not applied equally women do not enjoy the same protection as men

Source: Author's Original Work

Chapter 5

Conclusions

In the two cases representing successful adaptation, governments were the principle agents in managing natural resource shortages. They did not do this directly through policy and/or legislative efforts but instead did it indirectly by establishing social and economic conditions that were favorable for adaptation. When citizens were allowed to own property, provided with domestic and national security, government's enforced the rule of law, and invested revenues collected from the extraction of resources into infrastructure that facilitated economy wide development and diversification; individuals emerged with innovative solutions that solved their state's resource challenges.

Neo-Malthusians and Optimists view natural resource scarcity differently. The former advocate for political intervention designed to conserve and manage resources directly while the latter prefer political intervention that is limited to policies that enhance individual economic and social freedom. In the cases examined, governments did have an important role to play, however, that role was not necessarily a purely neo-Malthusian or Optimistic one. Instead, it was a combination of the two. Individual social and economic freedom resulted from favorable government policies limited to those mentioned above. In the non-adaptive state, individuals had little social and economic freedom as a result of state policies that extended beyond those of adaptive states. In the DRC, property rights are limited and as a result, individuals are not afforded the opportunity to improve the land and specialize in crops best suited for their soils. Subsistence agriculture predominates and because the largest non-agriculturally based industry is state owned, individual opportunities to develop specialized skills and trades are limited. Furthermore, government corruption and financial mismanagement of

state revenues hinders investment in infrastructure that will help develop and diversify the economy.

The Byzantines during the Early Middle Ages confronted natural resource shortages due to the scarcity of timber. Individual shipwrights working along the banks of the Golden Horn in Constantinople developed innovative methods for building ships that conserved these resources. The shipwrights enjoyed economic and social freedom because the state provided security, enforced an extensive legal system and invested revenues into projects that further developed and diversified the economy. Because individuals were allowed to own land, they could specialize in crops best suited for their soils. Food in excess of their own needs was traded for products they could not produce locally. Specialized agriculture produced an abundance of food and allowed some Greco-Romans to abandon agriculture and pursue specialized trades and crafts in the cities. The government collected taxes from this trade and used the revenue to protect the seat of government in Constantinople and the surrounding countryside through a state funded army and navy. Individual disputes and grievances could be settled peacefully and equitably through the legal system. The stable and secure social and economic conditions provided by the state were favorable for creativity and innovation within the community of shipwrights who assisted the state in adapting to its timber shortages by developing new construction methods that conserved resources.

The English during the Early Modern Period also confronted natural resource shortages due to the scarcity of timber. The English adapted to their natural resource shortages by substituting coal, an abundant resource, in place of charcoal in the production of many materials—the most important being iron. Many scholars contend this discovery made the Industrial Revolution of the eighteenth and nineteenth centuries possible. The government recognized the resource shortage and took action to try and manage it but these measures were

ineffective. The discovery that alleviated the shortages was made by an individual "tinkering with contemporary methods" and without the aid of organized institutionalized science.[155] The English iron worker, much like the Byzantine shipwright, enjoyed considerable social and economic freedom as a result of the government's policies that set the conditions favorable for adaptation to take place. The government supported the transition from open fields agriculture to one centered on individual land ownership. Enclosures allowed individuals to grow specialized crops best suited to their soils and environments which yielded a surplus of food and materials. This afforded some the opportunity to pursue specialized trades and crafts in London and the surrounding cities. The exchange of products and services provided revenue for the government which they invested into infrastructure. Dredging the waterways and ports improved the trade along the state's waterways and coasts and draining the Fens in the eastern part of the state increased the amount of land available for agriculture.

The state that demonstrated unsuccessful adaptation, the Democratic Republic of the Congo, is struggling to manage its supply of natural resources. Revenues collected from the extraction of natural resources are not invested in infrastructure or institutions that provide the social and economic conditions favorable for enterprising and innovative individuals to emerge. The Congolese do not have the same degree of economic freedom enjoyed by the Byzantines or the English. Individual property rights are not protected—forcing many to migrate into sensitive ecological environments to practice subsistence agriculture. Because time and energy are consumed meeting basic subsistence requirements, specialized skills needed to tackle the pressures facing the state are lacking. The government is not improving

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[155] McClellan, *Science and Technology in World History*, 280.

the situation either. Revenues are squandered and not invested in infrastructure to develop and diversify the economy.

Throughout history, natural resources have been critical to our survival and economic development. Unfortunately, these resources have not always been abundant and the scarcity of resources has incentivized human exploration and encouraged states to both conserve and adapt to resource shortages. Although natural resources are just one of the factors that can strain states, some have managed to adapt while others have struggled and teetered on the brink of collapse. These states are most likely to threaten regional, and at times, even global security. By examining the historical record, and identifying common factors and patterns between states that have adapted to resource scarcity we can begin to both anticipate where problems are likely to occur and develop strategies that allow states to successfully manage these challenges before they become a threat to either regional or global security.

Table 6: A Comparison of Social and Economic Factors across Case Studies

Factors	Byzantines	English	Congolese
Property Rights	Yes	Yes	Limited
Social Mobility	Yes	Yes	Limited
Specialized Labor	Yes	Yes	Limited
Fair Legal System	Yes	Yes	No
Security & Stability	Yes	Yes	No
Open Markets	In Constantinople - No	Yes	No
Revenues invested in economic wide development and diversification	Yes	Yes	No

Source: Author's Original Work

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